

REC'D 13 FEB 2003
WIPO PCT

INVESTOR IN PEOPLE

The Patent Office  
Concept House  
Cardiff Road  
Newport  
South Wales  
NP10 8QQ

**PRIORITY  
DOCUMENT**  
SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH RULE 17.1(a) OR (b)

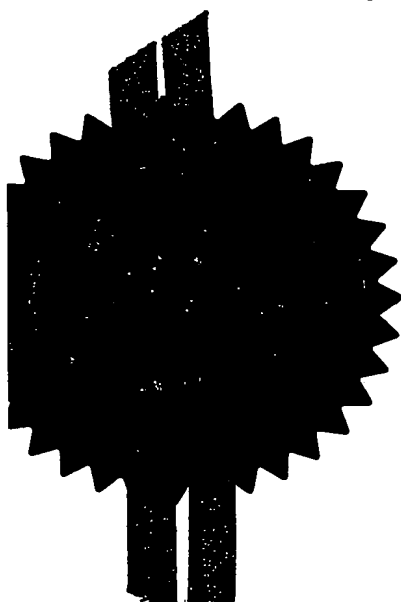
PC/GB 03/0068

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed *J. Behan*

Dated 20 January 2003

**BEST AVAILABLE COPY**

15 JAN 2002

RECEIVED BY FAX



15JAN02 E68 204-1 001091  
P01/7700 0.00-0200758.1

The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference

MN 1583 GB

2. Patent application number

(The Patent Office will fill in this part)

0200758.1

15 JAN 2002

3. Full name, address and postcode of the or of each applicant (underline all surnames)

JOHNSON MATTHEY PUBLIC LIMITED COMPANY  
2-4 COCKSPUR STREET  
TRAFALGAR SQUARE  
LONDON SW1 5BQ

Patents ADP number (if you know it)

536268007  
GB

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

HIGH TEMPERATURE DEVICES AND ARTICLES

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)  
IAN CARMICHAEL WISHART

JOHNSON MATTHEY TECHNOLOGY CENTRE  
BLOUNTS COURT  
SONNING COMMON  
READING RG4 9NH

Patents ADP number (if you know it)

72583/2001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, **YES**
  - b) there is an inventor who is not named as an applicant, or
  - c) any named applicant is a corporate body.
- See note (d))

**Patents Form 1/77**

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

0 /

Description

3 /

Claim(s)

1 /

Abstract

1 /

Drawing(s)

1 /

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

ONE /

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

*I C Wishart*

Date 15 Jan 02

I C WISHART

12. Name and daytime telephone number of person to contact in the United Kingdom

MRS F E STRANGE 0118 924 2125

**Warning**

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

**Notes**

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- For details of the fee and ways to pay please contact the Patent Office.

HIGH TEMPERATURE DEVICES AND ARTICLES

5 This invention concerns high temperature device and articles, meaning especially devices and articles used at molten glass temperatures, and which need to be protected from attack by molten glass.

10 In the glass industry, homogenising and gobbing stirrers are used. These parts require excellent high temperature strength at glass forming temperatures, which are generally in the range 1000 to 1250°C. The traditional material chosen for such parts is molybdenum (Mo) which is clad in platinum foil. Although Mo is resistant to molten glass, it is rapidly oxidised and volatilised in contact with air at temperatures above 700°C. To avoid oxidation, the Pt  
15 cladding must completely contain the Mo core and the space between the Pt cladding and the Mo part is evacuated to remove any oxygen. However, any direct contact between the Mo core and Pt cladding at elevated temperatures allows rapid inter-diffusion, so that the protection offered by the Pt cladding is compromised over time. It is therefore conventional to provide a protective coating on the Mo part, such as a sprayed ceramic, to act as a diffusion  
20 barrier. Such a multi-step construction adds complication and cost.

In recent years, oxide dispersion strengthened ("ODS") alloys have become available (examples include PM1000, PM2000, , MA758, MA956) with adequate high temperature strengths to act as stirrer cores for use in molten glass. Unlike Mo, these ODS materials do  
25 not catastrophically oxidise, but form relatively protective surface oxide layers. However these ODS materials are not resistant to molten glass and therefore still require protection in the form of Pt cladding. The Pt cladding does not have to be a complete containment because of the greater resistance of the core material to oxidation. Interdiffusion remains a problem if the Pt and ODS materials are in direct contact. Unfortunately the best types of ceramic  
30 interlayers which could be considered as a diffusion barriers, do not have expansion coefficients which match the requirements of the ODS alloys. Accordingly, these diffusion barrier layers can become damaged and spall off in service. In particular the possibility of using part claddings (an opportunity to reduce cost) requires that the diffusion barrier layer extend right up to (or just beyond) the free edge of the cladding. This is a vulnerable point

because if spalling of the interlayer did occur it could cause contamination of the glass.

There remains a need for a protected article which does not suffer significant interdiffusion yet retains adequate strength in a glass furnace. It is also an advantage if the interlayer is flexible under the conditions of operation such that it does not crack, crumble or spall.

Accordingly, the present invention provides a high temperature article comprising a base metal part and a platinum group metal ("PGM") protective layer, separated by a diffusion limiting layer, characterised in that the diffusion limiting layer is a foraminate PGM structure.

Desirably, the foraminate PGM structure is a relatively low-density fabric, including woven or knitted fabrics, felts and sintered non-woven fabrics. It should be understood that other structures are included within the broadest scope of the invention. These may be highly expanded PGM sheet, PGM sheets with impressed "pimples", and others. However, the presently preferred structure is a knitted PGM fabric. We refer to Johnson Matthey USP 5,266,293 which discloses the manufacture of such knitted fabrics as catalyst gauzes, especially for ammonia oxidation. Such knitted PGM fabrics are commercially available.

The PGM protective layer is preferably Pt or a Pt alloy. The foraminate PGM structure is preferably Pt or a Pt alloy. The preferred non-woven structures are made from thread or wire of approximately 50- 85 micron diameter or from ribbon.

Preferred PGM structures have open areas of 60% or more and densities in the range 250-1200g/m<sup>2</sup>. This permits air circulation, which has benefits with ODS materials in maintaining stable, protective oxide layers and also limits points of direct PGM-base metal contact. Knitted structures have additional advantages including flexibility, so that they can readily conform to the shape of the underlying part, which may be a stirrer with a complex external screw. A knitted PGM fabric has minimal contact points so that any diffusion has to be through the contact points and multiple thin wires or ribbon, thus reducing diffusion of species from the PGM protective layer to the base metal part and *vice versa*.

A preferred base metal part is made from ODS material such as that marketed as PM2000 (Plansee Metals Ltd).

The invention will now be described by way of example and with reference to the  
5 accompanying schematic drawing.

A PM2000 ODS part, 1, has a knitted Pt-5%Rh gauze (JM 'Nitroluk'), 2, applied  
thereto and fixed in place by hammer welding. Gauze 2 is knitted on a commercial knitting  
machine from 76micron Pt-Rh wire to a weight of 620g/m<sup>2</sup>. Fitted over the Pt gauze is a  
10 Pt cladding 3, constructed from 1mm thick Pt sheet by traditional methods.

A test article according to the invention has been tested in contact with molten glass  
for 1500 hours without failure or evidence of appreciable interdiffusion. The test is  
continuing.

15

The skilled person will be able to modify and optimise the invention without departing  
from its scope.

**CLAIMS**

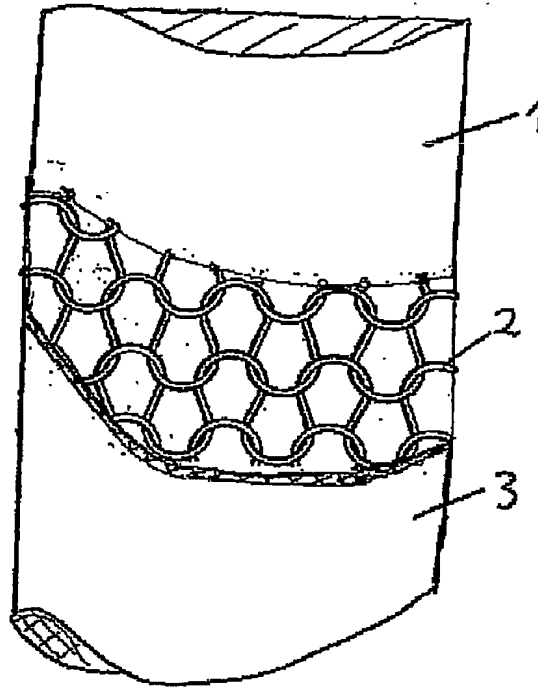
1. A high temperature article comprising a base metal part and a platinum group metal ("PGM") protective layer, separated by a diffusion limiting layer, characterised in that the  
5 diffusion limiting layer is a foraminate PGM structure.
2. An article according to claim 1, wherein the foraminate PGM structure is a fabric made from wire or ribbon.
- 10 3. An article according to claim 1 or 2, where both the PGM protective layer and the foraminate PGM structure are Pt or a Pt alloy.
4. An article according to claim 3, wherein the foraminate PGM structure is a layer of knitted or woven Pt wire or ribbon.
- 15 5. An article according to any of the preceding claims, wherein the base metal part is formed from ODS materials including PM2000, PM1000, MA758, MA956.
6. An article according to any of the preceding claims, in the form of a homogenising or  
20 gobbing stirrer or other metallic part for use in a glass furnace.
7. A diffusion limiting layer for use in the article of claim 1, formed from a knitted or woven Pt or Pt alloy fabric.

**HIGH TEMPERATURE DEVICES AND ARTICLES****Abstract of the Invention**

10 A device such as a stirrer suitable for contacting molten glass has a base metal component 1, a knitted Pt gauze layer, 2, and an outer Pt cladding, 3. The device exhibits resistance to attack by molten glass and resistance to interdiffusion between the Pt cladding and the base metal.

(Sole Figure to be used)





**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**